National Aeronautics and Space Administration

JANUARY 2015

SPACE LAUNCH SYSTEM HIGHLIGHTS

RS-25 Engine Testing Blazes Forward for NASA's Space Launch System

The new year is off to a hot start for SLS! The engine that will drive America's next great rocket to deep space blazed through its first successful test January 9 at the agency's Stennis Space Center near Bay St. Louis, Mississippi. The RS-25 fired up for 500 seconds on the A-1 test stand at Stennis, providing NASA engineers critical data on the engine controller unit and inlet pressure conditions. This is the first hot fire of an RS-25 engine since the end of space shuttle main engine testing in 2009. *(NASA/Stennis)*

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Space Launch System Booster Ready to Fire

A full-scale version of the booster for SLS is ready to fire for a major ground test and is paving the way on NASA's journey to Mars. The two-minute, full-duration static test — scheduled for March 11 at booster prime contractor ATK's test facility in Promontory, Utah — is a huge milestone for the program and will qualify the booster design for high temperature conditions. This type of test typically only comes after multiple years of development and signifies major progress being made on the rocket. Once this test and a second, low-temperature test planned for early 2016 are complete, the hardware is qualified and ready for the first flight of SLS. Read the full story **here**. *(ATK)*

RS-25 Engine Testing (cont'd)

"It was the culmination of a tremendous amount of work at Marshall, at Aerojet Rocketdyne and especially at Stennis Space Center," Liquid Engines Manager Steve Wofford said. "It was a great team accomplishment. I told our team that the engine ran on hydrogen, oxygen and especially on the hard work, dedication, and attention to detail from them."

The entire engine/test team faced several challenges to refurbish the test stand, develop a new engine controller and modify and test an RS-25 for the first time since 2009.

A technical issue that surfaced before the holiday break threatened to push the test date beyond a planned early-January facility outage at the A-1 stand. The team thoroughly assessed the issue and decided to proceed, concluding that the risk to the test engine and the chance of a premature engine shutdown were low. Ultimately, it required close cooperation among program, institutional and even commercial interests to carry out the test before the scheduled test stand shutdown.

"It was also a good study in risk management and the willingness to carefully assess, understand and accept a bit of elevated technical risk in order to achieve this major milestone for the engine office and SLS," said Bill Hill, deputy associate administrator for Exploration Systems Development.

Watch a video of the test **here**.

Spaceflight Partners: Dynetics

EDITOR'S NOTE: Every month, SLS Highlights turns the spotlight on one of the many industry partners helping to create the largest rocket ever built for human space exploration. In this issue, we profile Dynetics of Huntsville, Alabama.

Dynetics of Huntsville, Alabama, is supporting Boeing on work for the SLS core stage. *(Dynetics)*

Dynetics, an employee-owned, engineering and manufacturing company, is supporting Boeing in the manufacture and assembly of the intertank forward and the liquid hydrogen aft SLS structural test simulators. These simulators emulate mechanical properties for structural testing of the core stage intertank and liquid hydrogen tank. The intertank and liquid hydrogen tank are part of the SLS core stage, which will store cryogenic liquid hydrogen and liquid oxygen that will feed the vehicle's RS-25 engines. Boeing is designing, developing and manufacturing the 200-foot core stage for NASA.

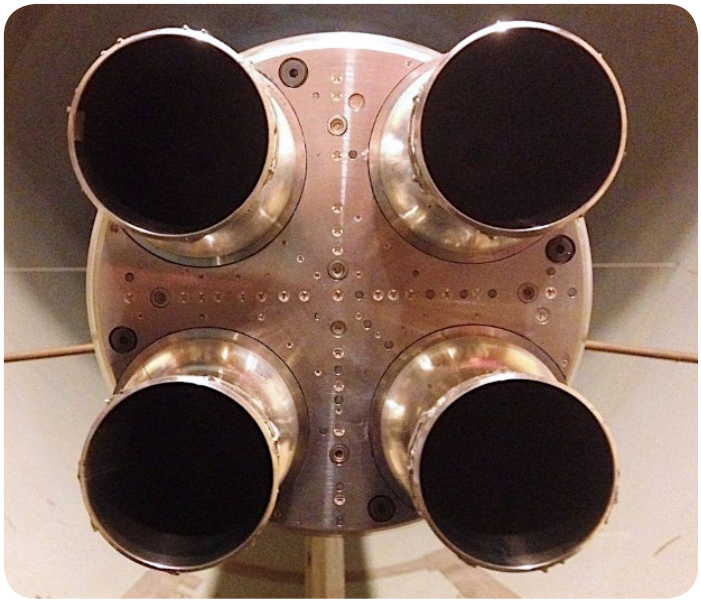
Each of the seven simulators used in structural tests are constructed in eight segments that form 27.6 foot diameter barrels. Dynetics will build two of those barrels using its Research and Development and Solutions Complexes in Huntsville, Alabama.
As a required step before the first flight test of the SLS, these structural tests executed at NASA's Marshall Space Flight Center will validate design and analysis activities and help qualify the SLS core stage design for flight loads.

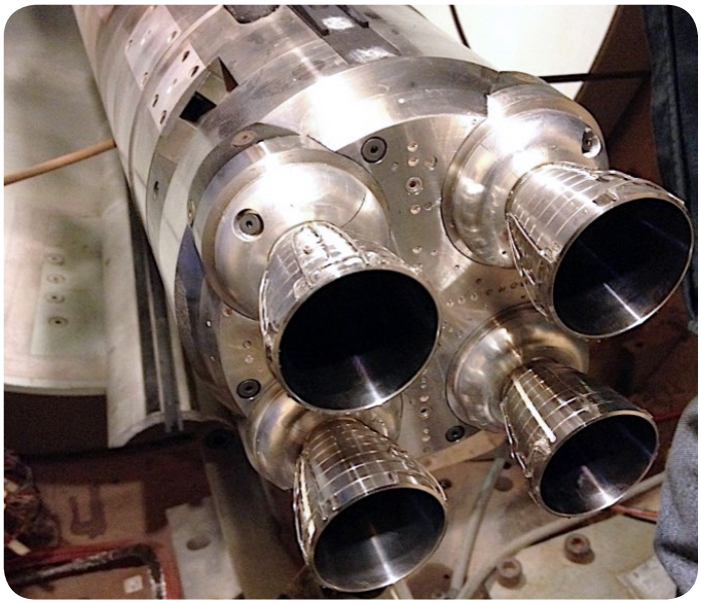
Dynetics also is working with Boeing on the development of the SLS core stage thrust vector control exhaust gas heat exchanger. The heat exchanger will use cold gas from the exhaust of the core stage auxiliary power unit to maintain an acceptable temperature range for the hydraulic fluid, used in the thrust vector control system.

In addition, Dynetics provides engineering support for the analysis and integration of the propulsion system. This includes thrust vector control performance analysis, as well as design and integration support for the propulsion system.

Mini Models Fire Up for SLS Base Heating Tests

A 2-percent scale model of the SLS core stage RS-25 engines, in the two pictures below, and a model of the SLS without the twin boosters, right, is used for nominal, core-stage-only testing at CUBRC, Inc. in Buffalo, New York. NASA is working in close collaboration with CUBRC to test mini models of the SLS propulsion system and entire vehicle in a shock tunnel at the facility. The test series will provide data on the convective heating environments that the base of the rocket will experience upon ascent. That data will be used to verify flight hardware design environments and set specifications for the design of the rocket's base thermal protection system. Read the full story **here**. (*NASA/MSFC*)





Composite Booster gets a Burst of Energy

Turning a rocket booster case into spaghetti sounds more like magic than engineering, but a test that did just that could be an important step in the future of human space exploration.

With an eye toward possible future upgrades to NASA's Space Launch System (SLS) rocket, the test involved pressurizing a booster structure made of composite materials to its breaking point to see how it compares with the metallic booster cases used currently. Using composites instead of metal structures presents the potential to improve the performance of the boosters.

In the "case burst test," a booster case 25 feet long and 92 inches in diameter was subjected to 3,000 pounds per square inch of pressure — well beyond what would be encountered in flight conditions — to verify exactly what sort of loads the composite material could withstand.

"The test is very dramatic," said Angie Jackman, of the SLS Spacecraft/Payload Integration and Evolution (SPIE) office at NASA's Marshall Space Flight Center in Huntsville, Alabama. The Marshall Center manages the SLS Program for the agency. "When composites fail, it's the glue or the resin that fails first — not the fiber that fails. There's a big boom, and it's all spaghetti."

Before the test, damage was caused at multiple points on the case to study what effect it would have on how the case failed. Even so, the damaged case performed as well as an intact case, demonstrating not only the composite case could withstand the rigors of space launch, in that it could do so even in a damaged condition.

The test was conducted by ATK of Promontory, Utah. ATK made the solid rocket boosters flown on the space shuttle and will provide the boosters for the first flights of SLS.

After the initial flights of SLS, the rocket will be upgraded from a configuration capable of delivering 70 metric tons (77-tons) to low Earth orbit to an evolved configuration that will launch 130 metric tons (143-tons). To reach its full

Standing more than two stories tall and almost 8 feet in diameter, the composite test structure was pressurized with water until it burst. *(ATK)*

capability, SLS will utilize more powerful boosters. NASA is preparing today for that evolution by working with industry partners to test technologies that could be used to develop new liquid or solid rocket boosters.

SLS Program Manager Todd May and SLS Boosters Manager Alex Priskos visited ATK on Jan. 13 in Promontory to recognize several teams who have

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Composite Booster (cont'd)

The successful test demonstrated that a composite case can withstand damage and still handle the stresses of space launch. *(ATK)*

worked on the SLS solid rocket boosters. The boosters will undergo their first preflight test this spring. May and Priskos met with the team who carried out booster forward skirt structural testing, then met with the group who worked upgrades to booster insulation processing.

After presenting team members with certificates of appreciation for their efforts, May and Priskos walked through several booster manufacturing areas to speak face to face with team members on the factory floor who are working on rocket motor manufacturing for NASA. A number of ATK team members mentioned how much the recognition from NASA meant to them.

Following the morning's recognition effort, May, Priskos and the NASA Spacecraft/Payload Integration and Evolution (SPIE) team toured an area of ATK's facility in Clearfield, Utah, and witnessed the rocket motor case burst test. The test demonstrated state-of-the-art composite structural technology as part of a collaborative NASA and ATK project.

During the test, the case failed within 1 percent of pretest estimates, validating the models for strength of the composites. One hundred twelve channels of instrumentation provided data on the case failure. The rocket motor case test is part of an effort to optimize a composite case design that may be stronger, lighter, yet more affordable, than traditional steel cases. In turn, this would provide increased payload performance due to reduced weight inherent in composite materials.

ATK leveraged 47 years of composite case winding experience, its experienced workforce and a modern fiber-placement tooling system to achieve success on this motor case.

On the Road...

The SLS Program's Steve Creech takes questions about the rocket from participants in a Museum Alliance Webcast Jan. 15. *(NASA/MSFC)*

NASA Associate Administrator Robert Lightfoot talks about SLS and other agency initiatives at the annual meeting of Downtown Huntsville, Inc. on Jan. 16 at the Von Braun Center. *(AL.com)*

The inflatable SLS and Orion were part of the Alabama Gubernatorial "Thank You Alabama" event Jan. 19 at the Crampton Bowl Multiplex in Montgomery, Alabama. *(NASA/MSFC)*

Follow SLS on:

SLS on Deck:

- Museum Alliance Webcast with SLS Boosters Office
- Hydrogen burn-off igniter unit testing for SLS
- Booster avionics delivered to SLS System Integration Laboratory